

# The Challenge of Black Spots

By Carter D. Roberts

Arson investigation is similar to the study of economics. While in college, I took a course called Micro Economic Theory in which the instructor taught us the basic economic theories such as the law of supply and demand, the law of diminishing marginal utility and the basic market models in a free enterprise system. The instructor explained, “all things had to be equal” – meaning all the variables had to be constant in order to apply the basic economic theory. Upon my successful conclusion of this basic course and having made a fairly decent grade, I was encouraged to sign up for Macro Economics.

In Macro Economic Theory I soon learned that all things were not always equal and the instructor told us to forget everything we had learned in Micro Economics. In short, we were to learn why things did not always work the way we had been taught.

As fire investigators it is necessary first to learn all the basic theories of fire; for example, fire burns up and not down and therefore, the point of origin is normally located at the lowest point of burning. If all things equal, this theory would hold true, but it does not take into account a possible polyurethane load or a heat inversion. In short, an arson investigator will need to consider all variable which will affect the normal burning in a structural fire. In order to do so, he must learn not only the basic theory of the fire but also those variables which will change or affect the basic burn patterns. All things being equal, a heat source applied to a vertical piece of plywood would result in an almost perfect V-

pattern, going up and outward from the point of origin. However, this theory does not take into account the air currents, heat radiation or other variables such as accelerants which would change the burn pattern of the wood. The effective arson investigator must go beyond theory and familiarize himself with variables affecting the basic theories of fire.



In arson investigation a structure which has been completely consumed by fire is most commonly known as a "black spot." There are several reasons for complete consumption of a structure. First, if a structure is completely removed from a town or city, fire suppression activities are delayed or inhibited because of an insufficient water supply. This situation is common in rural areas where there are no fire departments in the vicinity of the loss. Second, the structure may be composed of highly flammable materials rather than masonry, which would tend to burn more rapidly than a building of materials of heavier construction. Third, a structure housing flammable liquids such as petroleum would also tend to burn more rapidly. A structure will often be completely consumed in cases where a flammable liquid has been applied. A flammable liquid will not only increase the rapid spread of the fire but will also intensify the heat factor. It is not uncommon for a fire propagated with a liquid accelerant to consume all combustible materials and cause metal melting not normally associated with low heat source fires.

When faced with a black spot where all combustible materials have been consumed by the fire, an arson investigator will be tempted to assume all evidence has been destroyed by the fire. This is the course of least resistance and many investigators stop their investigations at that point. A black spot is one of the most difficult fire scenes to analyze successfully, but the task is not impossible.

Upon arrival at a black spot, the arson investigator should be equipped with all the necessary tools to conduct an investigation: Ax, broom, camera and film, chisel, coveralls, crescent wrench, crow bar, diagram sheet, electronic hydrocarbon sniffer, evidence labels, flat-blade shovel, gloves, hammer, hand cleaner, handheld light, magic markers, magnet, mariner's compass, metal containers/mason jars, nail proof fire boots, notebook, pipe cutter, saw, screw drivers; including a Phillips, tape measure (100 feet), towel, water bottle, wire cutters, wire gauge, and any other equipment needed in locating and identifying evidence. As arson is a physically dirty crime, the arson investigator must be willing to get his hands dirty. Just as a mechanic would not attempt to do a major overhaul of an engine without the proper tools neither can an arson investigator perform his job without tools.

An arson investigator arriving at the fire scene with all the necessary equipment to do an efficient and effective examination should first examine and photograph the exterior of the structure. Personally, I prefer to take photographs showing the vantage points of the four corners of the building, insuring that I have each side of the structure at least twice. It is also important to note during this portion of the examination any additional structures on the property and to examine them for contents. All incoming power and gas lines should be noted and photographed.

After setting a fire, it is not uncommon for an arsonist to discard a container of some type when leaving the area; therefore a search of the exterior should include both sides of all exits to the property. A thorough search of high weeds and ditches will often reveal evidence which may be linked to the arsonist. There are many search patterns which can be utilized such as a grid spiral or circle which narrow to the building. The arson

investigator should choose the pattern which best suits him and the area which is to be searched.

As an arsonist often plans his crime many weeks in advance, he will tend to become lax in the upkeep of the exterior. Therefore, the arson investigator should note if the exterior is unkempt and if there is a large amount of trash residue or other discarded items on the property. He should also take note of and examine all containers capable of holding a flammable liquid.

The investigator should be aware of footprints and tire impressions particularly in rural communities. Plaster of Paris casting is rapidly being replaced by new products capable of lifting impressions more effectively. Continued study and knowledge of advances in technology are necessary in the field of investigation.

An arsonist using a flammable liquid such as gasoline will normally saturate the structure and continue with a trail to the exit. If the arsonist has experienced premature ignition or the shock of an explosion after the accelerant reaches an explosive level, he may extend his trail out the building and onto the exterior grounds. The investigator should observe any burning extending beyond the confines of the structure. It is not uncommon for a liquid trail to extend as far as 50 to 100 feet from the structure, which provides evidence easily identified and which should be photographed.

A low order explosion normally occurs when a volatile liquid accelerant has been used and has reached an explosive limit prior to ignition. Window glass in this case will be blown some distance from the building. This glass will not contain much smoke residue and will be broken into larger pieces than glass exposed to a slow building fire. Glass blown from a building is a good indicator a flammable liquid was used in the initiation of the fire. Glass blown from one or two sides of the building will hint at the section or sections of the building where an accelerant was used. Judgment should be used as there are other variables to consider, such as natural gas explosion.

After examining and documenting the exterior the investigator faces the tedious work of examining the remains of the interior. As most combustible materials have been consumed by the fire, it is important to pay particular attention to the remaining non-combustibles such as metal. The normal structural fire will reach a heat stress between 350 degrees and 500 degrees at floor level. It will tend to burn about three times hotter at ceiling level or around 1600 to 1800 degrees. It should be noted, however, that polyurethane, urethane and styrene are substances which will greatly increase the heat stress factor. When these items are in abundance, temperatures exceeding 2000 degrees are common and the fire can spread as fast as 100 feet a minute. A building lined with styrene as an insulator will burn in a manner similar to a building soaked in gasoline. A considerable amount of styrene products are presently being used in dwellings and commercial structures.

As there are many variables affecting the thermal stress factor, it is important to know what the building contained prior to the fire. A structural layout of the building and the

materials used in its construction are also needed. A blueprint offers a basis with which to begin, but it should be used in conjunction with an interview of the owner or occupants concerning the contents of the building. I recall one particular fire where there was a clear and distinctive liquid accelerant pattern on a concrete slab. According to the blueprint, the pattern would have extended through a wall – an obviously improbable occurrence. Only after the owner was interviewed was it learned the building plans were altered to allow a hallway to extend through the area where the blueprint indicated a wall. When the new floor plan was obtained, it became clear the accelerant trail extended the length of the hallway and led to the front door.

As the cellulose materials are consumed in a building, the metals normally drop straight down from their original positions. In such a case, the careful investigator should note the metals such as door knobs, hinges and items from window locks to determine if they were in a locked/unlocked position or whether the doors or windows were open or closed prior to the fire. If the firemen were unable to gain entry into the building because of the extensive involvement of the building at the time of their arrival, the locking mechanisms may help determine if the doors were locked or unlocked.

If no variables are present which would cause excessive thermal stress within the structure, the temperature range should not reach the melting point of metals such as cast iron or structural steel. Copper should not melt at floor level and discovery of such would indicate the probable use of a liquid accelerant. If there is extensive metal melting in one area of the structure as opposed to other areas of the building, the investigator has a good indication of where an accelerant may have been used. It is imperative for the investigator to be familiar with different melting points of metals found in the average structure. The following is a list of melting points of metals. Metals which are not in a pure form will have varied temperatures.

Pure Iron	2795 degrees Fahrenheit
Ordinary Structural Steel	2606 degrees Fahrenheit
Copper	1981 degrees Fahrenheit
Gold	1945 degrees Fahrenheit
Silver	1761 degrees Fahrenheit
Brass	1570-1900 degrees Fahrenheit
Glass	1400-1600 degrees Fahrenheit
Aluminum	1218 degrees Fahrenheit
Zinc	787 degrees Fahrenheit
Lead	625 degrees Fahrenheit
Solder	361 degrees Fahrenheit

A knowledge of the melting points of common metals in structural fires makes it much easier to identify and locate areas of accelerant use.

Although intense thermal stress will diminish the chances of locating traceable amounts of volatile accelerants, in my opinion a sample should always be taken. Cognizant of the ever increasing incidents of arson, a hydrocarbon sniffer should be utilized to aid in the

location of possible sample collection areas. A negative sample should not hinder the ability of the investigator to determine if the fire was incendiary; positive samples support and strengthen courtroom testimony. A fire scene diagnosis is only an opinion, but should be supported with empirical, scientific evidence.

The presence of a liquid accelerant at the fire scene does not mean the fire was necessarily incendiary. The occupant of the structure should be interviewed to determine if any flammable liquids were stored within the structure. If there were any within the building, their location should be isolated and verified. If gasoline was allegedly stored only in the carport but some is found in the kitchen then a case for incendiarism is strengthened. As high pressure hoses are used in suppression activities certain materials will be scattered from their normal locations. Water will dilute the accelerant and strong concentrations of an accelerant should not be located very far from the area where they were originally stored.

The standard procedure of eliminating all other causes of a fire should be utilized with a black spot. All gas pipes should be checked and if there is any doubt concerning whether the valve is open or closed, it is possible to blow into the pipe to see if it was open. As arsonist will sometimes remove or open valves on gas pipes to contribute to the intensity of the fire. All heaters and gas stoves should be examined to see if they are in the "on" position. If a heater hose has been disconnected and the valve has been opened in several locations, it is safe to assume the fire was not accidental.

The electrical system should also be examined. During a fire, it is normal for heat first to break down the insulation of the wiring causing shorting in the ceiling area. When such shorting occurs and the wire contains an electromagnetic current, the wiring tends to form a ball where the melted metal is pulled back onto the wire. If such shorts do not exist, then the records at the utility company should be examined to see if electricity was in fact going into the structure at the time of the fire.

The investigator should be cognizant of subrogation possibilities when examining the fire scene. If the building was recently rewired and the fire originated within a fuse box, the investigator should examine such things as terminal lugs for tightness and proper materials being utilized. Seven to ten percent of all residential fires are attributed to electrical problems; however, a great number of these fires are the results of investigators who do not know the real cause or who were lax in examining the fire scene. I know some people who have determined the fire to be electrical when there was no electrical service to the building. Lightning striking the building is uncommon, however, the weather conditions at the time of the fire should be noted.

When examining a black spot, a thorough and complete inventory should be taken. The closets should be located and the number of coat hangers counted. Synthetic material will normally melt and stick to the coat hanger, indicating if clothing was on the hanger at the time of the fire. If an arsonist has committed the crime for economic reasons, he will often exaggerate his proof of loss. A thorough and complete inventory will support a case of fraud even if arson cannot be proved.

The debris will usually be in layers and each layer should be examined and an attempt made to ascertain what was in the building. The lower levels of the building would normally be more protected than the ceiling area and close examination of the lower levels of debris will prove most beneficial in providing evidence.

If the building is situated on a concrete slab, all debris should be removed and the spalling noted. Steam spalling will occur in new concrete as the result of moisture heating within the concrete. The expansion of steam will cause the concrete to flake. Normal spalling will have clear and sharp edges. When an accelerant has been used and allowed to penetrate part of the surface area, the spalling will not have as sharp an edge as observed in steam spalling. In addition, an accelerant pattern will follow a trail and proper cleaning will reveal splash patterns of the accelerant. In a black spot, it is easier to detect an accelerant when a concrete slab is available for examination. Gravity normally pulls the accelerant to the lowest points in the building and all cracks with the concrete should be examined to see if an accelerant was used. There are several items, such as calcium carbonate, which are useful in obtaining samples of accelerants from concrete. There are some experiments with clay base products and charcoal powder also being tried. I believe the new techniques and procedures will be improved and more effective methods of recovering traceable amounts of accelerants will be discovered in the near future.

If the building did not contain a concrete slab, then a dirt sample may be worthwhile. Dirt samples are not normally productive in finding accelerants, but they should not be overlooked. A 2.5 inch metal pipe with a handle welded to one end can be used to drive into the dirt. The pipe should be driven approximately eighteen inches into the ground and samples should be sealed in proper containers. It is sometimes difficult to remove the dirt from the pipe, but if the top end is left open a broom handle can be inserted to push the dirt into the container.

The length of time an accelerant will remain is debatable. Ether and acetone are both highly volatile lasting only a few minutes while substances such as isopropyl alcohol, gasoline and naphtha will last several hours, several weeks or up to a week respectively. Paint thinner and kerosene have a low volatility but they will last almost indefinitely. Mineral oil and fuel oil are only slightly volatile, but they will also last indefinitely.

There are many variables such as the type of accelerant used and environmental conditions. Once I worked a case in which a Jim Walter home had been completely consumed and the fire scene examination did not take place until one month after the fire. As it was in the hottest part of the summer and there had been no rain since the fire, a dirt sample was taken as described above with positive results for a known gasoline. The insured had stated he had no accelerant stored in or around the building but when confronted with the chemical analysis, he changed his story and stated he had used five gallons of gasoline to burn wasp nests from under his house the day of the fire. Without belaboring the obvious, it should be noted the investigator must be aware of sets, gasoline containers, and other items such as missing inventory items from the building. The black

spot is a challenge and it is a situation where vast experience and training pay off. After the interior fire scene examination, the most important part of determining the cause and origin of the fire begins – interviewing witnesses.

Many fire investigators depend only on the fire scene examination to determine the cause and origin of a fire. Some feel that dependence upon witnesses reflects incompetence and they believe they are able to determine the cause and origin of a fire and can disregard information obtained from witnesses. This is a myopic view and can be embarrassing to the investigator in a court of law.

The person who discovered the fire is probably the most important witness to interview. A competent fire department should have the name of the person reporting the fire. If this is not the case, a concerted effort should be made on the part of the investigator to locate and interview this person. After he is located, he should be interviewed and a statement should be taken. Information concerning why he was in the area and what brought the fire to his attention should be included in the interview. A proficient investigator must study and learn proper interviewing techniques. He should plan his interview so that he can obtain all the important facts. If possible, all outside and distracting stimuli should be removed. The witness' thought patterns should be kept in a logical sequence. There are many books available on the interviewing and interrogation techniques and the investigator should be familiar with their procedures.

It is best if only one person conducts the interview as more than one person directing the questions will break the concentration of the witness to the logical thought sequence and proficiency of recall will be diminished.

The discoverer of the fire can normally pinpoint the area where the fire first originated. Questions for the witness should include: where he first saw the fire, if it was burning high or low, what were the colors of flame and smoke and at what time the fire was discovered.

The normal structural fire involving cellulose by-products will emit white smoke during the initial stages only turning black when the roof area is reached. If the roof contains a petroleum product such as tar or asphalt shingles, the smoke will turn black and after the petroleum products have been consumed, it will turn white again. If the reverse occurs, the smoke is heavy and black, then white and then black again; it should be regarded as a suspicious fire. A variable to be considered in the smoke coloration occurs if the fire originates on a couch containing polyurethane or styrene. The smoke from this type of fire should be extremely black. In addition, substances such as plastics, linoleum and other petroleum based products will also cause heavy black smoke.

Most accidental fires are low heat source fires originating in a small area and then spreading upward and outward from the point of origin. If the fire is accidental in origin, the smoke first seen emitting from the building will not normally have access to a large amount of petroleum based products which cause heavy black smoke. As previously

stated, it is extremely important the investigator know the contents of the building, particularly in and around the point of origin.

The firemen first arriving on the scene are the second most important witnesses to interview. Information should be gained as to how and when the alarm was received, the distance of the station from the building and the time of their arrival. Firemen should be interviewed as to weather conditions, the status of the doors and windows upon arrival and if there were any unusual conditions affecting the spread or suppression of the fire. The amount of contents, whether the insured was present at the scene and any other unusual circumstances can usually be obtained from the firemen.

The neighborhood canvass should be thorough and conducted at a time when the majority of the neighbors will be home, such as late evening. Witnesses should be asked about any unusual events before the fire, such as the removal of furniture or personal items. Witnesses are important in determining if the fire was arson.

The isolation of rural areas will always be conducive to black spots and therefore the probability of determining the cause and origin is always lower than in the metropolitan areas.

The task of investigating a black spot requires more experience and training; however, if the investigator is willing to work methodically, time and effort will be rewarded. When examining a black spot, it will perhaps help the investigator to remember the three rules of Albert Einstein:

*First, out of clutter find simplicity; second, from discord make harmony; third, in the middle of difficulty lies opportunity.*